भारतीय मानक
Indian Standard

IS 40 : 2021

रोगन के लिए कार्बन ब्लैक — विशिष्टि

(दूसरा पुनरीक्षण)

Carbon Black for Paints — Specification

(Second Revision)

ICS 87.060.20

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भारतीय मानक ब्यूरो
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September 2021 **Price Group 5**

Raw Materials for Paint, Varnishes and Related Products Sectional Committee, CHD 21

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Raw materials for Paints, Varnishes and Related Products Sectional Committee had been approved by the Chemical Division Council.

This standard was first issued in 1950 based largely on the interim co-ordinated draft produced with the assistance of the representatives of manufacturers and of various departments and authorities of the Government of India by the Co-ordinating Subcommittee of No. 5 Standing Committee on Specification for Paints and Allied Stores of General Headquarters (now Army Headquarters).

The difficulties faced by the paint industry in getting supplies of correct quality material resulted in the review of the original standard. Such a review revealed that a revision of IS 40:1950, accommodating various types of the material like jet black for general purposes and having clean blue undertone will meet the requirements of the paint industry.

In first revision the classification of the material is based on the method of production, namely, furnace blacks, channel black, etc. The new requirements for colour value by Nigrometer, *p*H, moisture and fixed carbon have also been included.

The first revision also supersedes IS 41 : 1950, IS 42 : 1950 and IS 43 : 1950 and recommends the use of carbon black conforming to this standard in paint formulations in place of bone, vegetable and lampblacks which are neither produced in the country nor consumed by the paint industry.

Raw material for paint products may contain lead and other heavy and toxic metals either because of use as catalyst or use of heavy metal other than lead based compounds in manufacturing as additives for improving performance/stability of product. Taking cognizance of the fact that lead and toxic heavy metal exposure to human being, particularly to children in residential premises is injurious to health and having adverse impact on human health and safety, the Committee responsible for formulation of this standard has felt the need to introduce restriction of lead and toxic heavy metal in all paint raw material product standards. Revision of this standard has been taken up with a view to incorporate the maximum permissible limit of lead and heavy metal restriction clause in this standard. Therefore, in this revision, lead restriction up to a maximum permissible limit of 90 ppm and toxic heavy metals restriction as 0.1 percent maximum has been prescribed to avoid hazardous impact of lead and toxic heavy metal exposure and consequent adverse impact on environment and human health. Further, majority of consumers are not aware of the consequences of lead and other heavy metal toxicity and its long-term implications to human health. Therefore, in this revision, along with lead and toxic heavy metal restriction, a suitable cautionary notice has been included in the marking clause.

Further, the additional requirement of tinting strength and test method for the same has been incorporated. The requirement of colour (blackness), nigrometer index has been removed due not in used in paints industry and. References have been updated as well.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CARBON BLACK FOR PAINTS — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes requirements and methods of sampling and test for carbon black for paints.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1303 and following shall apply.

3.1 Ambient Temperature — It is a temperature between 21 °C and 38 °C.

3.2 Standard Atmospheric Conditions for Testing — An atmosphere with a relative humidity of 65 ± 5 percent and a temperature of 27 ± 2 °C provided that in a given series of experiments, the temperature does not vary by more than ± 1 °C.

4 CLASSES AND TYPES

4.1 The material shall have the following classes:

a) *Class* 1 — Channel black, and
b) *Class* 2 — Furnace black.

4.1.1 The channel black shall have jet black undertone.

4.1.2 The furnace black shall have two types:

a) *Type* 1 — For general purposes; and
b) *Type* 2 — For tinting purposes having a clean blue undertone.

5 REQUIREMENTS

5.1 Form and Condition

The material shall be supplied in the form of dry powder or in such a condition that it can be reduced to the powder form by crushing, without grinding action, under a palette knife.

5.2 Lead Restriction

The material shall be tested for restriction from lead in accordance with IS 101 (Part 8/Sec 5), or by Atomic Absorption spectrometer or by ICP. When thus tested the material shall not contain lead or compounds of lead or mixtures of both, calculated as metallic lead exceeding 90 ppm (*see* Note).

NOTE — When no lead is used during production, the product is considered lead free.

5.3 Toxic Heavy Metal Restriction

Product shall not be manufactured using mercury and mercury compounds, cadmium, chromium VI, arsenic, antimony and their oxides. The material shall not contain more than 0.1 percent by weight in total of above toxic heavy metals in the form of natural impurities or impurities entailed by the production process which are contained in the raw material when tested by the relevant Atomic Absorption Spectroscopic methods.

5.4 The material shall also conform to the requirements given in Table 1.

6 PACKING AND MARKING

6.1 Packing

The material shall be packed in polyethylene bags which in turn shall be packed in three-ply paper bags or in containers as agreed to between the purchaser and the supplier.

6.2 Marking

6.2.1 The containers shall be marked with following details:

a) Name of the material;
b) Manufacturer's name and trade-mark, if any;
c) Mass of the material;
d) Lead content (Maximum);
e) Toxic heavy metals content;
f) Batch number or Lot number in code or otherwise;
g) Month and year of manufacture; and
h) A cautionary note as below:
    1) Keep out of reach of children.
    2) This product may be harmful if swallowed or inhaled.

Table 1 Requirements for Carbon Black for Paints

(*Clause* 5.4)

Sl No.	Characteristic	Requirement		Method of Test
		Class 1	Class 2	
i)	Volatile matter, percent by mass, *Max*	15	3	8 of IS 33
ii)	Moisture, percent by mass, *Max*	1	1	Annex B
iii)	Residue on sieve, percent by mass, *Max*	0.2	0.2	9 of IS 33
iv)	Oil absorption gm/100 gm	275-375	Within ± 10 percent of approved sample	10 of IS 33
v)	Matter soluble in water, percent by mass, *Max*	0.25	0.25	19 of IS 33
vi)	Fixed carbon, percent by mass, *Min*	85	97	By difference of 100-volatile matter
vii)	*p*H value, *Max*	4	5-9	21 of IS 33
viii)	Acetone extract, percent by mass, *Max*	0.02	0.5	
ix)	Ash, percent by mass, *Max*	0.02	0.5	24 of IS 33
x)	Tinting strength (percent ITRB)	58-60	58-60	Annex C or ASTM D 3265

6.2.2 *Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING

Representative sample of the material shall be drawn as prescribed in **5** of IS 33.

8 TESTS

8.1 Tests shall be conducted as prescribed in **5.2** to **5.4**.

8.2 Quality of Reagents

Pure chemicals and distilled water (*see* IS 1070) shall be used.

NOTE — 'Pure chemicals' shall mean chemical that does not contain impurity, which affect the results of the analysis.

9 CRITERIA FOR CONFORMITY

A lot shall be declared as conforming to this standard if the test results of the composite sample satisfy the requirements prescribed under **5**.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
33 : 1992	Inorganic pigments and extenders for paints — Methods of sampling and test
35 : 1975	Zinc oxide for paints
79 : 1975	Linseed stand oil for paints
101 (Part 8/Sec 5) : 1993	Methods of sampling and test for paints, varnishes and related products: Part 8 Tests for pigments and other solids, Section 5 Lead restriction test
229 : 1993	Ethyl acetate
231 : 1957	Amyl acetate
1070 : 1992	Reagent grade water
1303 : 1983	Glossary of terms relating to paints
9788 : 1981	Titanium dioxide, rutile for paints

ANNEX B

[*Clause* 5.4, *Table* 1, *Sl No* (ii)]

DETERMINATION OF MOISTURE

B-1 GENERAL

B-1.1 Outline of the Method

The material is heated under reflux with an organic solvent which is immiscible with water. The carrier liquid distils into a graduated receiver carrying with it water which then separates to form the lower layer, the excess carrier liquid overflowing from the trap and returning to the still.

B-2 APPARATUS

B-2.1 The dean and stark apparatus used for determination of water content has the following essential features.

B-2.2 Flask — Of 500 ml capacity, as shown in Fig. 1, and made of hard resistance glass, well annealed and as free as possible from striae and similar defects. Alternatively, a metal flask may be used.

B-2.3 Condenser — Made of hard resistance glass, well annealed and as free as possible from striae and similar defects, with shape and dimensions as shown in Fig. 2.

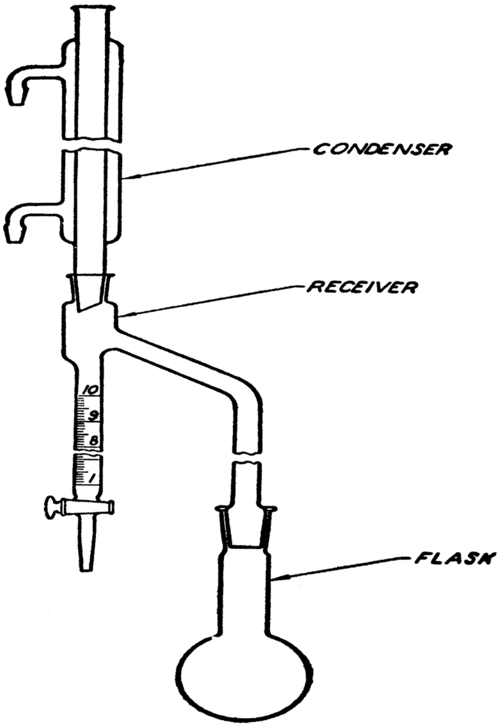

Fig.1 Dean and Stark Assembly (with 10-ml Receiver)

B-2.4 Spray Tube — Made of glass, sealed at one end, having four small holes equidistantly placed around the wall near the closed end of the tube, with the shape and dimensions as shown in Fig. 2.

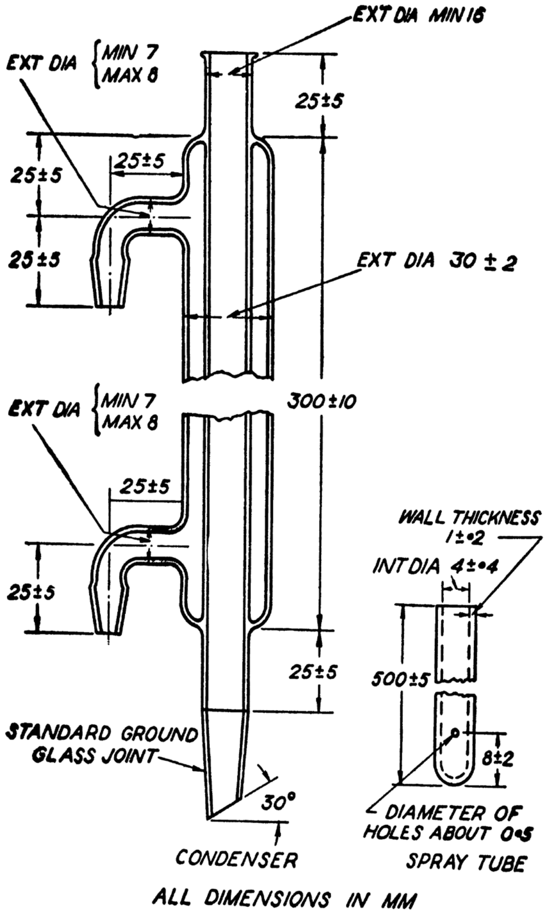

FIG. 2 CONDENSER AND SPRAY TUBE
(DEAN AND STARK APPARATUS)

B-2.5 Two-Millilitre Receiver — Made of hard resistance glass, well annealed and as free as possible from striae and similar defects, provided with ground glass joints, and of shape and dimensions given in Fig. 3. It consists essentially of the upper chamber together with the tube and ground joint leading to the flask and the graduated tube. When a metal flask is used, care shall be taken to provide an air-tight connection between the flask and the receiver. The graduated portion shall have a capacity of 2 ml at 20 °C when filled to the highest graduation mark. The scale shall cover the range of 0.1 to 2 ml and shall be divided into intervals of 0.05 ml. The graduation marks corresponding to 0.5, 1.0, 1.5 and 2.0 ml shall be numbered. The numbered graduation marks shall be carried completely round the tube. The graduation marks corresponding to 0.15, 0.25, 0.35 ml and so on up to and including 1.95 ml, shall be carried halfway round the tube. The remaining graduation marks shall be intermediate in length and shall project equally at each end beyond the shortest graduation marks. The error at any point on the scale shall not exceed ± 0.03 ml and the difference between the errors at any two points shall not exceed 0.03 ml.

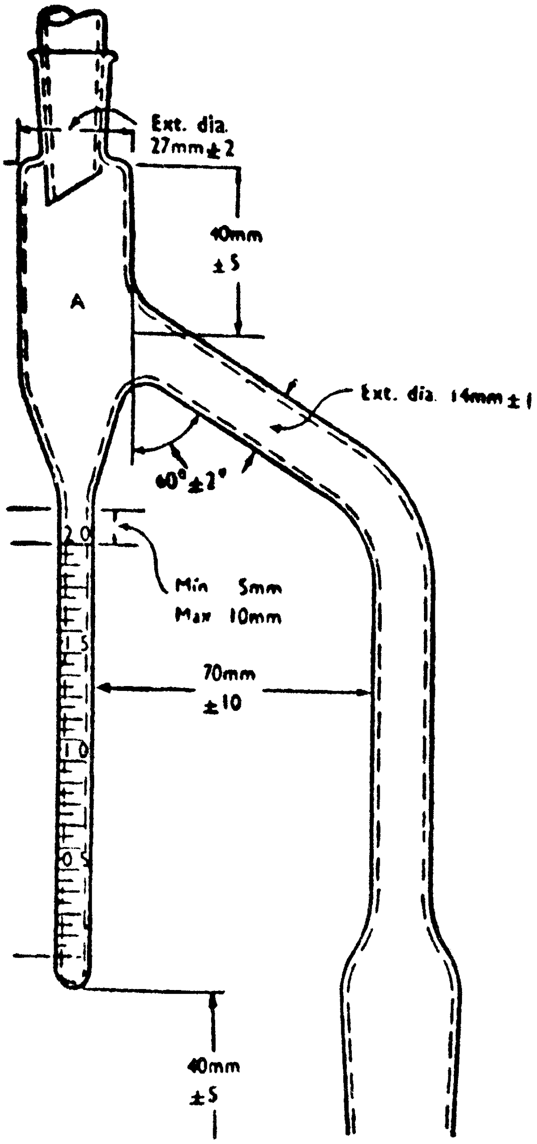

FIG. 3 2-ML RECEIVER
(DEAN AND STARK APPARATUS)

B-2.6 Graduated Cylinder — 100 ml.

B-3 PROCEDURE

B-3.1 Weigh 100 g of the material in the flask, add 100 ml of dry petroleum hydrocarbon solvent (boiling point 75° to 85 °C) and 1 ml of dry ethyl acetate (conforming to IS 229) or amyl acetate (conforming to IS 231) and thoroughly mix the contents of the flask. Pour petroleum hydrocarbon solvent into the receiver up to the level of the side tube. Attach the flask to the

Dean and Stark condensing the collecting system and heat the flask at such a rate that the condensate falls from the end of the condenser at a rate of two to five drops per second. Continue the distillation until condensed water is no longer visible in any part of the apparatus except at the bottom of the graduated tube and until the volume of water collected remains constant. Remove the persistent ring of condensed water in the condenser tube, if any, by increasing the rate of distillation by a few drops per second. Wash droplets of water which adhere to the lower end of the condenser tube into the receiver with petroleum hydrocarbon solvent, using the spray tube.

B-3.2 Note the number of millilitres of water in the receiver at the temperature at which the sample was measured. Assuming the density of 1.00 g/ml for the water collected in the receiver, calculate the percentage of water (by mass) in the material.

ANNEX C

[*Clause* 5.4, *Table* 1, *Sl No* (x)]

RELATIVE TINTING STRENGTH

E-1 PRINCIPLE

E-1.1 The test pigment and agreed reference pigment are dispersed in medium consisting of mixture of an alkyd resin, dispersing agent and grinding media using Vibro Shaker. The resulting dispersions of test pigment and reference pigment are mixed with known quantity of white alkyd enamel paint to get a smooth uniform tinted mixture. The intensity of colour and hue of the resulting mixture is compared with each other using color measurement machine and relative tinting strength of test pigment is reported as percentage in comparison to reference pigment.

E-1.2 The degree of development of tinting strength of a colored pigment is dependent on the amount of work done in the preparation of the dispersion. Therefore, in determining the relative tinting strengths of two coloured pigments it is necessary for the comparison to be carried out at the level of maximum development of colour. In this method, which uses a vibro shaker, development of tinting strength is influenced by simultaneous reciprocation and radial tilting in vibration and perfect colliding harmony of grinding media.

E-1.3 The appropriate ratio of pigment to medium, by mass, depends not only on the oil.

absorption of the pigment but also on the viscosity of the mix during the grinding operation. Necessary adjustments need to me made to maintain grinding viscosity.

E-2 APPARATUS

E-2.1. Vibro Shaker

It is an electrically operated mechanical shaker which has two oscillatory motions, parallel and perpendicular to vertical plane which ensures desired degree of dispersion of pigment. Vibro shaker with digital stopwatch should fulfill following requirements.

Parameter	Requirement
No. of oscillations/MIN	640-660
Reciprocation of central shaft	13-15 mm
Angular displacement	27 + 1 degree
Relative motion of counter weight	Opposite
Vibration level	Negligible
Distance of centre of cup to center shaft	56-60 mm
Cup holder dimensions [Inside Only] mm	115 × 90 × 60 +10
Calibration of timer	28-32 min

E-2.2 Stainless steel containers :125 ml stainless steel container with inner fitting lid [52 mm diameter × 78 mm height (inner lid fitting)].

E-2.3 Grinding Media

Steel balls :3-4 mm diameter.

E-2.4 Drawdown Papers — Size 9” × 5” white paper panel of thickness 0.3 mm for assessment, use 9” × 5” of width 0.3 mm white paper panel with black strip of minimum 5 cm width. White portion should have tri-stimulus value Y > 78. Black portion should have tri-stimulus value Y < 5. Gloss of black portion should be less than 5 units at 20° gloss head [Connecting reference IS 101 Part 4/Sec 4].

E-2.5 Filtering Nylon Cloth — [100-120 mesh size].

E-2.6 Film Applicator — Suitable for applying two or three films side by side of pigment dispersion, thickness 50 to 150 µm.

E-2.7 Balance — Accurate to ± 0.0001 g.

E-3 REAGENTS

E-3.1. **Alkyd Resin** — Long oil air drying alkyd (60 ± 1 percent nonvolatile matter). This medium should have viscosity 70 ± 5 secs. on FC B4 at 30 °C. Viscosity can be adjusted by using mineral turpentine oil. [Connecting reference IS 11811].

E-3.2 Dispersing Agent — Mixture of 30 percent of zinc octoate (6 percent w/w), 30 percent of monoglyceroid of soya oil [72 ± 1.5 percent nonvolatile matter, 18 ± 4 acid value, K-T gardner viscosity] and 40 percent of dipentine.

E-3.3 Mixed Drier — Mixture of 21 percent of zirconium octoate (18 percent w/w), 6.45 percent of cobalt octoate (6 percent w/w) and 72 percent of calcium octoate (3 percent w/w).

E-3.4 White Alkyd Enamel Paint

Any commercial white alkyd enamel paint consisting of 62-66 percent of long oil air drying alkyd (60 ± 1 percent solids) and 13-17 percent of titanium dioxide [complying to **IS** 9788]. The paint shall have weight per liter of 1± 0.05, finish of 7 on Hegmann scale, nonvolatile matter of 58 ± 3percent and viscosity of 90 ± 10 sec on FC B4 at 30 °C.

E-4 PROCEDURE

E-4.1 Preparation of Pigment Dispersion

E-4.1.1 In stainless steel container weigh 1.4 g of testing pigment followed by 1 g dispersing agent and 10 g of alkyd resin. Add 150 g of Steal balls as grinding media and cover it with lid. Lid should be properly fitted to container. Similarly weigh reference pigment in another stainless steel container. Clamp the weighed stainless steel containers (sample and reference standard side by side) on vibro shaker and grind the dispersion for 30 min. In case of agglomeration or improper grinding, amount of alkyd resin can be increased or decreased in installments to achieve smooth dispersion.

E-4.1.2 Add 56 g of alkyd resin followed by 4 g of mixed drier in both test and reference container. Again keep both the containers (sample and reference standard side by side) on vibro shaker and mix the dispersion for another 5 min.

E-4.1.3 Filter the pigment dispersion obtained in **E-4.1.2** using nylon cloth and collect the dispersion in a clean and dry container.

E-4.2 Preparing Tinted Paint

Mix 4 percent of pigment dispersion prepared in **E-4.1** with 96 percent of white alkyd enamel paint in a stainless-steel container. Cover it with lid and ensure that the lid is properly fitted to the container. Repeat the procedure for reference pigment dispersion in another stainless-steel container. Clamp the weighed stainless steel containers (sample and reference standard side by side) on vibro shaker and mix the dispersion for 5 min.

E-4.3 Determining the Relative Tinting Strength

E-4.3.1 Place a clean drawdown paper on a flat glass/metal sheet and label one side as test specimen and another side as reference. Using a spatula, mix the tinted paint prepared in **E-4.2** for 2 min. Repeat the procedure for reference paint. Drop small amount of both the paints on draw down paper (side by side) and cast a drawdown using 150 micron bar applicator. Ensure that the paint forms two uniformly thick strips not less than 25 mm wide with touching edges not less than 40 mm long. Allow the drawdowns to dry overnight in dust free location. After drying, make an visual assessment of difference in colour strength and hue. Also measure the tinting strength on color computer using following instructions.

Illuminant	:	D 65
Observer	:	10°
Mode	:	Specular Included
Geometry	:	d/8
Colour measurement system	:	CIE or system as specified.

E-4.3.2 Determine the tinting strength of test pigment at 520 nm wavelength. While calculating strength, use the equation given below and Saunderson's coefficients K_1 = 0.04 and K_2= 0.6 for correction of surface and internal reflection.

$$\text{Corrected reflectance R'} = \frac{R - K_1}{[(1 - K_1 - K_2 * (1 - R)]}$$

K_1 = 0.04 It is coefficient for correction of surface reflection;

K_2 = 0.6 is coefficient for correction of Internal reflection; and

R = Measured percent reflectance/100.

In the next step, use Kubelka-Munk equation to determine K/S:

$$\frac{K}{S} = \frac{(1 - R')^2}{2R'}$$

where

K = coefficient of absorption;

S = coefficient of scattering; and

R' = corrected reflectance.

$$\text{Tinting strength, percent} = \frac{(K/S)\text{ sample}}{(K/S)\text{ std.}} \times 100$$

NOTES

1 Measurement of tinting strength is carried out as such and not in adjusted condition.

2 It is observed that under certain conditions like high humidity and low temperature, paint dispersion does not dry completely even after overnight drying. In such case, it is necessary to allow paint to dry further. It will be good practice to expose paint panel in environment chamber with humidity conditions less than 70 percent and temperature set at 30 °C.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Raw materials for Paints, Varnishes and Related Products Sectional Committee, CHD 21

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Organization	*Representative(s)*
In personal capacity (Retired from IIT Bombay)	Prof A. S. Khanna
Office of Micro, Small and Medium Enterprises, New Delhi	Shri Sunil Kumar Newar Shri Santosh Kumar (*Alternate*)
Harcourt Butler Technical University, Kanpur	Dr P. K. Kamani Dr Arun Maithani (*Alternate*)
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Institute of Minerals and Materials Technology	Nomination Awaited
University Institute of Chemical Technogy, Jalgaon	Prof Ravindra Puri
Shriram Institute of Industrial Research	Shri A. K. Majumdar
Central Electro Chemical Research Institute, Karaikudi	C. Arunchandran D. Sherwood (*Alternate*)
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Heubach India, Mumbai	Shri J. I. Sevak
Hindustan Zinc Limited, Delhi	Shrimati Payal Chauhan
Indian Chemical Council	Nomination Awaited
Indian lead zinc development association, New Delhi	Shri K. Sridhar
Indian Small Scale Paint Association	Shri Mukund Hulyalkar Shri Mukesh Goyal (*Alternate*)
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Shalimar Paints Limited	Shri Gokul C. Sutradhar Shri Chinmaya Nayak (*Alternate*)
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20 Microns Limited, Mumbai	Dr Anil Bansal

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Consumer Voice	SHRI M. A. U. KHAN SHRI B. K. MUKHOPADHAYA (*Alternate*)
BIS Director General	AJAY K. LAL SCIENTIST 'E' AND HEAD (CHD) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary

PUSHPENDRA KUMAR
SCIENTIST 'B' (CHD), BIS

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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